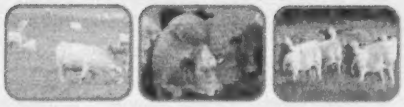

Virtual Beef

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In This Issue

The Nutritional Philosophy of Beef Cows

Christoph Wand, Beef Cattle & Sheep Nutritionist (with contributions from the OMAFRA Nutrition Team)

Did the Great Philosophers Learn from Beef Cows?

Sometimes nutritionists disagree. Most of the time when producers observe such a disagreement they ask, "How can that possibly be?". In a discipline filled with tables such as those produced by the National research Council (NRC) and good peer-reviewed research, this seems crazy. But it's not! Recently, I have been trying to identify the philosophies that have guided my perspective on all things nutritional. I feel my thinking has been influenced by my repeated circling back to the concepts of simplification, reducing over-formulation, strategic over-formulation, ration grouping strategies, and the fact that the beef cow is a great biological buffer. And I also believe discussing a nutritionist's guiding perspectives alone can be helpful, and tell you as much about nutrition as about the nutritionist.

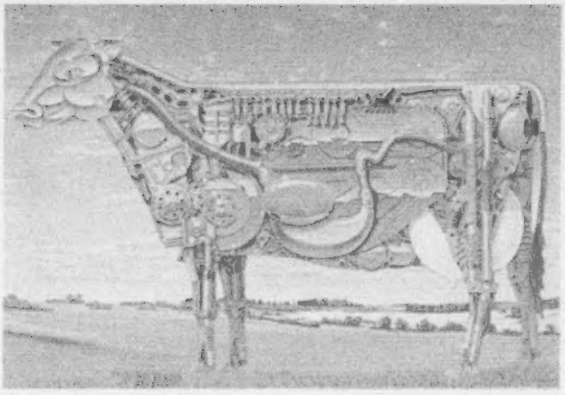

Figure 1. The beef cow is not a machine, she is a biologic organism with a large capacity to buffer environmental impacts.

Five Powerful Perspectives

Simplify, simplify, simplify! – Dr. Joe Rook served for many years as the Extension Ruminant Veterinarian at Michigan State University (MSU). His consistent advice to producers was to "*simplify*". It is often pointed out that feed represents a large part of the beef cost of production (COP). However, in an industry that rarely talks about return to labour or return on management, labour costs are actually huge too. 'Simplifying' means to critically evaluate management practices to reduce unnecessary busyness[1] and complexity on a farm. Dr. Rook's approach struck a chord with me. Some examples I have advocated:

- Rather than using routine selenium injections at birth, just make sure the routine mineral program is high enough in selenium (and other minerals). Minerals are being fed in one way or another, and doing this supplementation right reduces the need for this other job at a stressful time.
- Group animals by nutritional need rather than other descriptors such as age, breed, species, stage of production etc., in order to reduce animal management groups. (More on ration grouping later.)

Reduce over-formulation - As mentioned previously, we nutritionists hold many tables and data 'near and dear' whether on paper or electronically in ration software. The goal of nutrition is to match nutrients offered (and consumed) to the animal's requirements. A key detail often over looked is that nutrition is applied to a biological system, and is a dose-response relationship, rather than one defined by rigid requirements!

An approach that was long used and still used by some is intentional over-formulation to ensure all nutrients were exceeded; "the more, the better" or a saturation approach. In fact, much of this mentality is enshrined in federal regulations. This approach however, comes with financial (nutrient cost) and environmental downsides (nitrogen and phosphorus output in particular); even if performance improves, it will on a curve of diminishing return. For these reasons I have spent much of my career working on initiatives to help better balance nutrient intake and requirements to avoid excess nutrient intake, especially excess protein and phosphorus.

Strategic over-formulation – It has been pointed out that if you have 2 nutritionists in a room, you have 3 differing opinions; so here's a contribution! I am promptly going to disagree with my last section, or so it may seem. There will be times where a ration can be over-formulated for reasons that have nothing to do with requirements, or the diminishing (flattened) part of the curve - but this needs to be strategic!

Here are a few examples:

- When a particular ingredient is so inexpensive relative to other feeds we embrace the issues of oversupply of a particular nutrient for the greater good. Good pastures may fall into this category, as did dry distillers grain (DDGS) a few years ago. With DDGS we just managed the downside of excess protein, phosphorus and sometimes sulphur to harness the economic value. But, when that ingredient price changes, we need to move back into balance, which so often does not happen when people achieve a 'recipe' for performance success.

- In an attempt to **simplify**, we may use the same ration (and pasture counts as a ration) for two management groups. The ration may indeed be over-formulated for one group, but the net value of simplifying outweighs the downside of over-formulating for the other group

Grouping rations – this philosophy relates to the three presented so far, but especially to simplify. The approach can be used on pasture or for TMR rations with success. Again, the point here is to avoid unnecessary management groups on pasture, or unnecessary trips with the mixer (or other stored feeds) in confinement. The dairy industry did a great job of this a decade or so ago after it first embraced TMR feeding. One often heard discussions about 'high' and 'low' and 'dry' group rations. Many have likely gone too far from this and have now simplified too much to the detriment of the cows. The key in this type of grouping is identifying groups with similar needs on paper and managing by body condition score (BCS) and rates of gain, versus the ration specifications per se[2]. In other words, this is based on animal husbandry, not blind adherence to tables and formulations, and the willingness to re-group as needed.

For example:

- Thin mature cows and growing heifers (first and second calvers) might form a group, and mature cows in BCS 3.0 or higher another one for winter feeding
- Grazing together May-calved lactating cows, their calves and growing heifers (everything but the bulls) in late spring and early summer.
- Keeping in mind I am a beef and sheep nutritionist, I have advocated on several combined beef and sheep operations that rams and bulls can be fed/grazed together. Breeding females of both species too. Imagine that, big and little ruminants getting along! Don't allow species to limit your thinking.

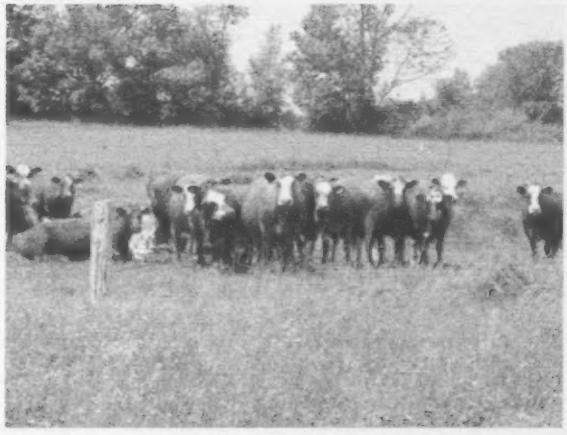

Figure 2. Pasture is an excellent example of simplicity in beef production[4].

Beef Cow = Buffer – Likely one of the most profound assets the beef industry has going for it is the ability of the mature cow to withstand a wide variety of conditions, feeds, climates, production systems and managers. She is the finest buffer in agriculture! This buffering capacity can be used to mitigate[3] not only climate and management, but also nutrition. That way the nutrition program can be stair-stepped, rather than needing to match an infinitely complicated curve. She can use body reserves to address short-term challenges in each energy, protein and minerals which are reflected in BCS, muscling and bone/tissue/plasma mineral fluxes respectively. Provided she is healthy, the beef cow never needs a perfect ration. She will build and use body fat, protein and minerals as needed.

Philosophy and Beef Cow Nutrition

The concepts of simplifying, reducing over-formulation, strategic over-formulation, ration grouping and the buffering ability of the beef cow have shaped all my technical thinking on ruminant nutrition. They guide me in the projects I take on, the advice I give and why I see the beef cow and beef industry as special. Used in combination and with good judgment, the idea is that these 5 philosophies can improve the life and profitability of the farmer, and enhance the well-being of the beef herd. It's okay to let farming and philosophy mix and allow differing perspectives to mingle in finding the best solution for you!

[1]lively but meaningless activity.
[2]in itself
[3]To lessen in force or intensity; to make less severe
[4]William of Ockham (1287-1347, an English Franciscan friar, scholastic philosopher and theologian) stated in his principle of economy "***Frustra fit per plura quod potest fieri per paucior***" or "It is futile to do with more things that which can be done with fewer". Pasture is an excellent example of this in beef production, and it meets the '*simplify*' test when done correctly.

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De-Coding the Code, Chapter 2 Feed and Water

Nancy Noecker, Cow Calf Specialist

The new Code of Practice for the Care and Handling of Beef Cattle was released in the fall of 2013 [https://www.nfacc.ca/codes-of-practice/beef-cattle]. This is the industry's statement on how it collectively thinks cattle should be raised and handled. So if you are part of the industry, this is YOUR document and you should know what is in it. Get over the fact that it is 60 pages long. Only the first half is the actual code, and that is laid out with a lot of space to make it easy to read. The second half contains references, a glossary, contacts and extension information.

When we break the Code down chapter by chapter, and work through it that way, it gets much easier to understand and put it into practice. It is not prescriptive about HOW we get to an outcome, but that we DO get there. **Requirements** that producers **need** to **provide** are highlighted in a yellow box for quick and easy reading. This is followed by some **recommendations** that almost always would be part of a Best Management Practices system (BMP's) for raising beef.

Chapter 1 has been reviewed in a previous edition of OMAFRA ***Virtual Beef*** http://www.omafra.gov.on.ca/english/livestock/beef/news/vbn0214a2.htm

Chapter 2 is about **Feed** and **Water**.

The desired outcome is that cattle are in optimum health and body condition. So in the case of feed, the producer requirements are...

REQUIREMENTS

Monitor cattle behaviour, performance, body condition score and health on an ongoing basis and adjust the feeding program accordingly.

Ensure cattle have access to feed of adequate quality and quantities to fulfill their nutritional needs at all times, and maintain proper body condition, taking into account factors such as: age, frame size, reproductive status, health status, level of production, competition and weather.

Take prompt corrective action to improve the body condition score of cattle with a score of 2 or less (out of 5).

Take steps to prevent exposure of cattle to toxins (such as lead batteries, fertilizer, treated seed, anti-freeze, nitrates) and to avoid feed with adverse physical qualities that could cause injury or limit intake.

So that is easy to understand, and makes sense if our goal is to have productive cattle that we are hoping to make a profit from. It goes back to the old adage "you can't starve profit out of a cattle beast".

Figure 1. Water pumped from a natural water source to a large tank - this keeps the water clean and the cattle out of the mud.

The only new requirement in there, is really to take a look at the body condition score (BCS) of your cattle and act if it is less than 2. If you are not familiar with BCS, then in the back of the code on pages 42-44 there are examples with good instructions and illustrations. This is working from the Canadian BCS system which runs from a score of 1-5. In this system 1 would be a bone rack and the 5 would be a blimp. Producers can all get barn-blind or herd-blind so it might be a good option to have a couple of people score the cattle and take an average, or get an outside opinion.

In an ideal world the cattle would all run about a 3, however we know cows will vary through the year depending on their pregnancy state and production level. It is probably desirable to have her gain weight after weaning and then milk some of it off her back in early lactation. If asked or challenged the trick would be for many producers to prove that they do Body Condition Scoring and take action based on the results. Many producers make a mental note, but the problem is getting it to flow down your arm and out your fingers in a notation in a book, or typed into a smart phone. The solution to that is to create a record a few times a year. Include the date, cow #'s and their condition, and if you regrouped the herd or changed the ration make sure that is recorded too. Most producers would do scoring at 2-3 months pre-calving, then 1 month pre-breeding and again after weaning.

Stopping the exposure to toxins also makes total sense. No one sets out to get cattle

Figure 2. Winter conditions where beef cows have lots of hay rolled out to reduce competition for smaller cattle.

Stopping the exposure to toxins also makes total sense. No one sets out to get cattle poisoned. Exposure is usually the result of an accident –the cattle got out or are at a new pasture. Although it takes time, the cure for that is still checking fences, latches on gates and walking new or unfamiliar pastures.
The recommended practices also touch on feed testing, using a nutritionist, good feed storage, regional mineral deficiencies, no quick ration changes and extra bunk space for less competitive cattle. These all fit into Best Management Practices (BMP's) for cattle if the producer is looking for profit.

Water is the other half of this chapter. Requirements for producers are...

REQUIREMENTS

Ensure that cattle have access to palatable water of adequate quality and quantity to fulfill their physiological needs. Monitor water sources, feeding habits, behaviour, performance and health on an ongoing basis and be prepared to adjust the watering program accordingly.

Snow may only be used as a sole winter water source providing it is of sufficient quantity and quality to meet the animals' physiological requirements.

Snow must not be used as a sole water source for the following cattle:

- ***lactating, or***
- ***newly-weaned, or***
- ***that have a body condition score of less than 2.5 out of 5, or***
- ***that don't have access to optimal feed resources.***

Only adequate quantities of clean, loose snow may serve as the sole water source. Monitor snow conditions on an ongoing basis.

Have a back-up water source in the event of insufficient loose snow or an interruption in water supply.

The code is not prescribing how your cattle are watered or by what source, but it is simply stating that you need to be aware of your cattle's drinking behaviour and provide "good" water in adequate amounts for all.

Using snow for a water source actually is referring to western operations, but can also be common in Northern Ontario and other regions with consistent snow fall and cover. It does require them to have lots of loose fluffy snow and can't be used if the cattle have any extra demands on them. Even then producers will need to have a back-up plan in case something goes wrong. This could mean a portable tank and trough, access to a natural water course, or moving the cattle to a facility where there is running water. Again the Code is looking for the result or outcome, not how you accomplish it.

As in all the sections, the recommended practices listed below the water requirements are not set in stone but certainly would be included in most BMP's. Is the water easy for cattle to find? This is especially important if you are moving calves into a feedlot. After all, if they don't drink, they don't eat, and they don't then have the energy to mount a good immune response when challenged by disease. If the water system is automated, then check every day that it stays automated. Try for cleanliness-if you wouldn't want to drink it would your cattle? Make sure the water lines and troughs are big enough for your herd's size and don't create competition among the cattle. If natural water sources can be pumped to troughs or tanks it may keep the water cleaner and the animal healthier. In winter situations try to restrict the cattle from thin ice areas. If consumption is low consider testing the water or check for stray voltage signs.

If, as a beef producer, these **Requirements** and **Recommendations** seem new or extreme to you, then you need to be having a conversation with your Veterinarian, Provincial Beef Association or local Beef Extension staff. That conversation needs to focus on how you can change the operation around, to provide what is asked for in the Code. Both your farm and the whole industry will be judged by your compliance.

So that concludes chapter 2 of the Beef Code of Practice, and nothing in it is too extreme. Most beef producers in Ontario and Canada are already implementing these practices. The challenge for most will be to have a paper trail, or to create one, that can prove to our consuming public that we are providing quality care to our cattle.

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Can I do that on Grass?

Jack Kyle, Grazier Specialist

With increased interest in grass fed beef, people ask if it is possible to fatten cattle on pasture without grain supplementation. The answer is yes, with a few conditions. When grass finishing animals, remember that the market is generally not looking for as much fat cover as normally found on grain finished animals. If you are not looking to finish cattle but rather achieve maximum growth on pasture the same pasture management principals will apply.

First and foremost, what is the quality of the pasture? To achieve optimum production you need lots of good quality pasture. However, unlike with stored forages and grains, producers often don't have an accurate quality assessment of their pastures. This is because pastures grow and are utilized directly by the animal without ever being formally harvested or analyzed.

Stored forage and grains have a known quality and energy level – either from feed analysis or from a long consistent history of grading standards and nutritional analysis. Although it is often produced on farm, you still have a good indicator of the feed quality, especially in the case of grains.

With pastures, there is a wide range in species make up, including any number of mixtures of legumes and grasses, with each species having a different feeding value. There is also the maturity factor – pastures may range from lush and vegetative to those which are mature and woody. Obviously, the lush and vegetative pastures will provide much higher quality feed, and you will have far greater success finishing cattle on this than a mature, woody pasture. This range in quality has a tremendous effect on animal performance, especially with livestock requiring more than a maintenance ration.

In a research project conducted at the Ontario Agricultural College in the 1960's, forage quality at various stages of growth was determined. For alfalfa, the range was from a high of 20.8% CP (crude protein) and 70.6% IVD (in-vitro digestibility) in the younger plants to a low of 15.6% CP and 60.1% IVD in the more mature plants. For Orchard grass, the protein ranged from 13.3% to 6.6% and digestibility ranged from 74.7% to 51.8%, showing a decrease in value as the plant matured. Timothy and brome grass showed similar declines in quality as orchardgrass (Table 1). When the digestibility of forage decreases, the intake also declines. This comes as a double hit because the animals are eating less of a lower quality feed, resulting in poor performance. To finish well, cattle will need high intakes of quality forage. If pastures are managed to be grazed when the plants are in the vegetative state, with maximum animal intake, excellent growth and production results are achievable.

Table 1: The effect of advancing maturity on the quality of four forage species[1].

	Vernal Alfalfa*		Climax Timothy		Frode Orchardgrass		Saratoga Bromegrass	
	%IVD	%CP	%IVD	%CP	%IVD	%CP	%IVD	%CP
Boot	70.6	20.8	70.9	10.6	74.7	13.3	75.1	13.4
Heading	65.9	17.7	64.1	8.9	71.2	11.0	69.1	10.0
Flower	63.0	16.7	56.6	6.9	61.3	8.2	59.4	6.7
Early Seed	60.1	15.6	53.1	5.7	51.8	6.6	59.7	5.8

*Alfalfa – medium bud, very first flower, full flower, early seed

[1]From Research Review of Forage Production Crop Science OAC 1983, R.S. Fulkerson

The second condition required to successfully finish on pasture is good pasture management. How do you manage your pastures and your grazing to achieve these results? Staging the pastures to create a wedge of forage with the last pasture grazed being the thin edge of the wedge and the next pasture to be grazed is the thick end of the wedge. If animals are moved every one to two days they will always have fresh high quality forage available that will meet the nutritional requirements for excellent growth. To support pasture finishing, pastures should be maintained with forage grasses in the boot stage and legumes in late bud to early flower stages. By maintaining and monitoring this "wedge" you will have the opportunity to adjust your grazing program to maintain quality pasture from May through to October.

This example for a 12 paddock system shows the available feed in animal days per acre for each paddock. The animals will start in paddock 1 and by the time they get to paddock 12, the first one will have regrown to provide abundant high quality forage (Figure 1).

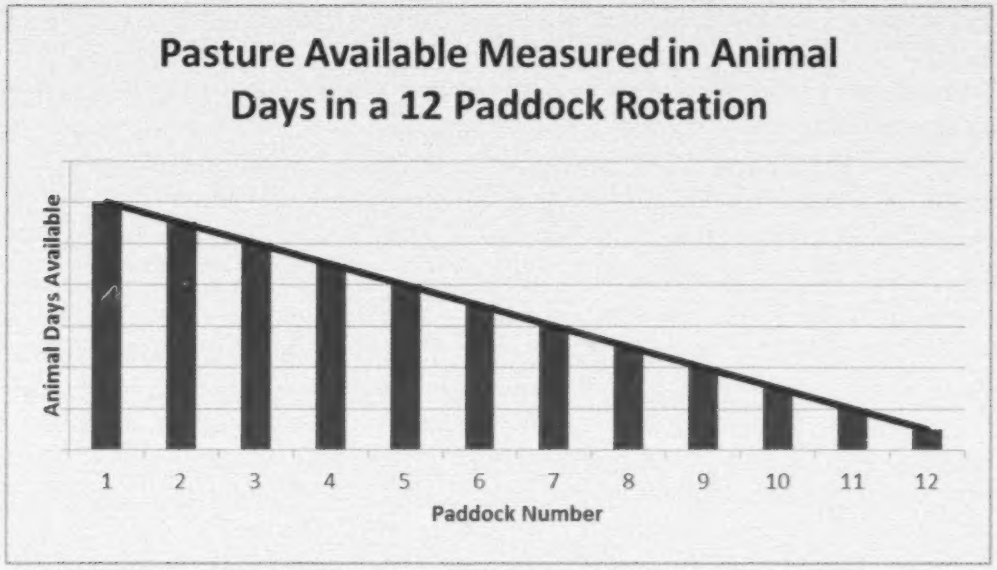

Figure 1: Illustration of the wedge technique for pasture management.

Animals come out of paddock 12 (the thin end of the wedge) when the forage is sufficiently grazed and moved into paddock 1 (the thick end of the wedge) where there is ample supply. Animals will rotate through the 12 paddocks so that while one is being grazed the other 11 are in a state of regrowth. Ideally, by the time animals have grazed through paddocks 1-11, and are ready to be back in paddock 12, it will have regrown enough to be the thick end of the wedge again.

Perennial pastures have minimal input costs and very low maintenance cost when compared to annual crops, stored forage or grain crops. By maintaining quality pasture throughout the grazing season, you create the lowest cost feeding program, while still achieving gains comparable to any other feeding program. It is the dollars you have left that determine your profitability, not the gross revenue. Well managed pastures are an opportunity to have a profitable bottom line and access a niche but growing market for grass fed beef.

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The True Value of Beef to Ontario's Economy

Tom Hamilton, Beef Program Lead – Production Systems

Ontario's beef industry is characterized by diverse primary production systems, a variety of end product specifications, and a host of wholesale and retail market segments. No wonder industry wide consensus on most topics is difficult to achieve! But one thing that all participants can agree on is that our beef industry is very important to the provincial economy. But how can we best measure that value?

Traditionally, the economic value of agricultural sectors has been equated to their total farm gate sales. For beef in Ontario, that figure has averaged an impressive **one billion dollars** annually for calf and cattle and sales, for a number of years. However, we know that the beef industry extends well beyond the farm gate – to slaughter plants, further processing, distribution and retailing. When all of these parts of the supply chain are counted in, the total value of sales increases dramatically, to about **13 billion dollars per year**! (Table 1).

And the number of jobs which are directly related to beef production, processing and retailing are equally impressive

Primary production	11,000
Processing	8,000
Retail	42,000
Total	**61,000 jobs**

Wow – over 60,000 people are employed in raising beef animals, carcass fabrication and further processing, and getting the product into the hands of the end user! (Table 3). And these jobs not only represent economic value, but also social value. Farmers typically rate their job satisfaction as very high – they love what they do. Beef farm families are strong participants in the rural community infrastructure, and create jobs in local towns in the service and supply sectors. Processing and retailing jobs are concentrated in cities, amplifying the impact of beef farming on employment well beyond the farm. The transportation industry also benefits from domestic beef production, as cattle are typically trucked several times between pasture and packer, and the distribution of products to wholesalers, retail chains and food service locations keeps drivers on the go.

However, simply using revenue or jobs by themselves is not the best way to evaluate an industry's overall economic contribution. According to OMAFRA Senior Economist Steve Duff, there is a more accurate way to determine the true contribution an industry makes to our fiscal well-being – **Gross Domestic Product (GDP)**. Gross Domestic Product is a superior method, in part because it is based on the sum of the **economic value added** at each step in the supply chain. This **total value added** is made up of direct, indirect and induced effects. **Direct effects** include the increase in value of an animal being fed home grown feeds - what our beef farm operations excel at - and is the base of the value chain. The industry also purchases materials and services from supplier firms, who in turn make further purchases from their suppliers. These contribute to the **indirect effects** on **GDP**. As well, people employed in the industry and in firms supplying related services earn incomes, part of which **they** spend on consuming goods and services – this contributes to the **induced effect** on **GDP**.

Beyond the Dollars

The non-economic benefits of beef farming also have to be recognized. Beef farms grow large amounts of soil building forages, which replenish organic matter in crop rotations and stabilize fragile erodible soil in permanent stands. Beef pasture lands provide nesting habitat for grassland bird species and other ecosystem services. And in the case of shallow soils or steep slopes, permanent pasture creates the means to produce a high quality protein source for humans from land which is not capable of human edible crop production. Against the back drop of steadily increasing world population, shrinking global supply of arable land and environmental degradation, these are attributes which should not be taken lightly.

The annual contribution of beef to Ontario's GDP averages **$2.70 billion** (Table 2), a significant part of the powerful agricultural economic engine which is an important driver of the province's economy. Maintaining this amount is key to the province's well-being. If production is lost from the province (for example, replacing homegrown feeder cattle with more western imports, or fed cattle slaughter with boxed beef from the US), our economy undergoes a significant setback. Jobs are lost and GDP goes down.

But the converse is also true – increasing the provincial production of calves, and thus increasing the total number of cattle on feed and the total number of head flowing through our packing plants with 'born in Ontario' animals should pay big dividends. It would allow Ontario to fully accrue the benefits of a re-tooled and vibrant beef sector by capturing all of the new added value at the cow-calf level and most of the added value at the feedlot level; since currently idle feedlot capacity would be brought back into production, without displacing current feedlot activity. As well, there is underutilized capacity in Ontario's processing sector, and a strong demand on these plants to produce more product. So if the increased feedlot output was absorbed by processing plants and was added to their current output, the province would benefit from the high marginal value added at that level as well.

But it all starts with the cow herd – those ladies are the foundation of any sustainable beef industry!

Table 1. Ontario Agriculture Total Sales Revenue from Primary, Processing and Retail, by Commodity, Adjusted for Product Imports ($Cdn Billion)*

	2007	2008	2009	2010	2011	5 Yr Avg
Grains & Oilseed	25.83	30.85	31.39	34.54	36.27	31.77
Potato	0.90	1.12	1.29	1.29	1.15	1.15
Greenhouse Vegetables	6.23	6.53	7.82	8.32	8.28	7.44
Field Vegetables	5.99	5.83	6.34	6.37	6.38	6.18
Fruits	2.99	2.87	2.79	2.59	2.60	2.77
Nursery & Floriculture	8.32	7.71	8.98	8.53	8.23	8.36
Maple	0.13	0.16	0.28	0.21	0.33	0.22
Tobacco	0.66	0.50	0.55	0.63	0.54	0.58
Cattle	12.46	13.62	12.36	13.10	13.21	12.95
Hogs	11.27	10.64	9.84	10.40	12.06	10.84
Sheep	0.61	0.62	0.71	0.76	0.77	0.69
Dairy	22.70	22.28	23.61	23.57	23.88	23.21
Poultry & Eggs	12.59	13.66	14.57	13.99	14.71	13.90
Honey	0.11	0.10	0.12	0.19	0.22	0.15
Other Domestic	4.64	4.74	4.84	5.42	4.90	4.91
Total Domestic	115.42	121.23	125.50	129.92	133.54	125.12
Other Sourcing	17.27	18.66	19.41	19.48	21.06	19.18
Beverages	4.05	3.96	4.05	4.02	3.96	4.01
Total	136.73	143.85	148.96	153.41	158.56	148.30

*Adapted from James, Staciwa and Duff. 2013. *A Statistic for Ontario Agri-Food Contribution by Primary Sector.* OMAFRA.

Table 2. Ontario Gross Domestic Product from Primary, Processing and Retail Sectors by Agricultural Commodity, Adjusted for Product Imports ($Cdn Billion)*

	2007	2008	2009	2010	2011	2012	6 Yr. Avg.
Grains & Oilseed	6.72	7.68	7.53	8.09	8.14	8.68	7.81
Potato	0.23	0.28	0.31	0.3	0.25	0.22	0.27
Greenhouse Vegetables	1.67	1.71	1.9	1.96	1.88	1.76	1.81
Field Vegetables	1.56	1.48	1.51	1.46	1.38	1.35	1.46
Fruits	0.78	0.73	0.67	0.59	0.56	0.46	0.63
Nursery & Floriculture	1.99	1.8	1.94	1.81	1.72	1.66	1.82
Maple	0.03	0.04	0.06	0.04	0.07	0.03	0.05
Tobacco	0.38	0.28	0.29	0.32	0.32	0.33	0.32
Cattle	2.81	3.00	2.55	2.69	2.68	2.49	2.70
Hogs	2.51	2.31	2.00	2.09	2.39	2.29	2.27
Sheep	0.14	0.14	0.15	0.15	0.15	0.13	0.14
Dairy	4.55	4.4	4.45	4.33	4.29	4.17	4.37
Poultry & Eggs	2.76	2.91	2.92	2.76	2.84	2.9	2.85
Honey	0.02	0.02	0.02	0.03	0.04	0.04	0.03
Other Domestic	1.04	1.01	1.01	1.13	0.94	1.07	1.03
Total Domestic	27.19	27.77	27.31	27.74	27.65	27.57	27.54
Other Sourcing	3.74	3.96	3.73	3.69	3.91	4.08	3.85
Beverages	2.34	2.21	2.14	2.07	1.98	2.13	2.15
Total	33.27	33.94	33.18	33.51	33.54	33.78	33.54

*Adapted from James, Staciwa and Duff. 2013. *A Statistic for Ontario Agri-Food Contribution by Primary Sector.* OMAFRA.

Table 3. Ontario Agriculture, Total Employment from Primary, Processing and Retail by Commodity, Adjusted for Product Imports (# of jobs)*

	2007	2008	2009	2010	2011	2012	6 Yr. Avg.
Grains & Oilseed	115,974	133,727	132,515	141,444	145,035	164,257	138,825
Potato	4,713	5,804	6,176	5,990	5,065	4,880	5,438
Greenhouse Vegetables	37,621	36,329	41,113	43,209	41,390	39,728	39,898
Field Vegetables	31,699	30,221	30,259	29,475	28,122	29,666	29,907
Fruits	16,499	17,655	16,131	13,284	13,974	10,605	14,691
Nursery & Floriculture	52,944	44,799	49,718	45,885	42,302	42,371	46,337
Maple	1,033	1,318	2,256	1,480	2,726	1,002	1,636
Tobacco	4,570	3,759	4,209	4,664	6,092	4,927	4,704
Cattle	62,650	66,862	58,784	59,869	61,207	56,908	61,047
Hogs	52,203	49,107	43,241	43,828	49,693	47,011	47,514
Sheep	4,645	4,213	4,356	4,752	4,364	4,081	4,402
Dairy	110,311	104,027	109,793	106,289	108,844	107,231	107,749
Poultry & Eggs	62,588	65,936	65,466	60,968	63,351	64,984	63,882
Honey	1,496	1,353	1,755	2,240	2,285	2,630	1,960
Other Domestic	38,186	42,192	41,149	39,489	35,621	41,926	39,761
Total Domestic	597,135	607,303	606,921	602,867	610,070	622,207	607,751
Other Sourcing	94,010	101,440	98,389	93,020	96,900	105,326	98,181
Beverages	10,151	10,204	10,587	10,670	10,419	12,198	10,705
Total	701,295	718,948	715,897	706,556	717,389	739,731	716,636

*Adapted from James, Staciwa and Duff. 2013. *A Statistic for Ontario Agri-Food Contribution by Primary Sector.* OMAFRA

Table 4. Ontario Agriculture, Comparative Measures of Economic Output by Commodity for 2011, Adjusted for Imports*									
	Revenue ($Cdn billion)			GDP ($Cdn billion)			Employment		
	Primary	Processing	Retail	Primary	Processing	Retail	Primary	Processing	Retail
Grains & Oilseed	2.79	9.14	24.34	1.28	2.9	3.96	3,333	28,130	113,573
Potato	0.10	0.21	0.84	0.04	0.07	0.14	341	773	3,950
Greenhouse Vegetables	0.70	1.47	6.11	0.39	0.49	1	7,228	5,606	28,556
Field Vegetables	0.54	1.15	4.69	0.25	0.37	0.76	1,898	4,303	21,920
Fruits	0.22	0.48	1.9	0.1	0.15	0.31	3,351	1,743	8,880
Nursery & Floriculture	0.81	0.4	7.03	0.45	0.12	1.15	8,315	1,112	32,875
Maple	0.03	0.01	0.28	0.01	0	0.05	1,367	45	1,315
Tobacco	0.11	0.43		0.05	0.27	-	4,686	1,406	-
Cattle	1.01	3.26	8.94	0.25	0.9	1.54	11,066	7,999	42,142
Hogs	0.94	2.95	8.17	0.23	0.83	1.33	4,242	7,408	38,043
Sheep	0.06	0.19	0.52	0.01	0.05	0.08	1,460	472	2,432
Dairy	1.90	5.43	16.55	0.47	1.13	2.7	20,760	10,788	77,296
Poultry & Eggs	1.20	3.02	10.48	0.3	0.84	1.71	6,909	7,535	48,908
Honey	0.02	0.01	0.19	0.01	0	0.03	1,349	31	905
Other Domestic	0.48	0.23	4.19	0.22	0.07	0.65	15,794	662	19,165
Other Sourcing		2.77	18.3	-	0.82	3.1	-	5,582	91,318
Beverages		3.96		-	1.98	-	-	10,419	-
Total	10.90	35.11	112.55	4.06	10.99	18.49	92,100	94,013	531,276

*Adapted from James, Staciwa and Duff. 2013. *A Statistic for Ontario Agri-Food Contribution by Primary Sector*. OMAFRA

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